POVIDONE-IODINE AS A SPORICIDE
By Louis Gershenfeld *

The sporicidal action of iodine has been known for many decades (1). Numerous reports concerning its sporicidal efficiency have been presented since the turn of the century (1-9).

This in vitro study was undertaken to determine the sporicidal efficiency of Povidone-Iodine, an iodine-liberating complex, and to evaluate such sporicidal efficiency with that of other commonly used skin antiseptics.

Experimental

Test Bacteria
1. Bacillus subtilis.
2. Clostridium perfringens (Bacillus welchii).
3. Clostridium tetani (Bacillus tetani).

In each instance, three different strains of each of the above were tested separately. Furthermore, in each instance, 24 hour-old, 72 hour-old, one week-old, and 2 month-old cultures of the nine test bacteria (three strains of each species) were tested separately.

Temperature
All tests were conducted separately at 20°C. and at 37°C.

Culture Media
Thioglycollate Broth Medium was used for culturing the test bacteria. Thioglycollate Broth Medium containing 0.5% sodium thiosulfate, 0.5% Tween® 80, and 0.07% lecithin was used as the transplant medium. The sodium thiosulfate inactivates free iodine which may be carried over. The Tween® 80 and lecithin serve as inactivators for the quaternary compounds and hexachlorophene, and thioglycollate as inactivator for the mercurials.

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Products Tested

1. Povidone-Iodine Solution\(^1\)
   containing 1% available iodine.

2. Rubbing Alcohol Compound\(^2\)
   containing 70% absolute alcohol by volume.

3. Iodine Tincture, U. S. P.
   containing 2% free iodine, 2.4% sodium iodide, and 47% alcohol.

4. Merbromin Solution, N. F.\(^3\)
   a 2% aqueous solution.

5. Nitromersol Tincture, N. F.\(^4\)
   containing nitromersol 1:200 in 50% alcohol and 10% acetone.

6. Thimerosal Solution, N. F.\(^5\)
   containing 0.1% thimerosal.

7. Hexachlorophene Emulsion\(^6\)
   containing 3% hexachlorophene W/W in colloidal dispersion in sodium octylphenoxethyl ether sulfonate, lanolin cholesterol, and petrolatum.

8. Benzalkonium Chloride Solution\(^7\)
   a 0.1% aqueous solution.

9. Benzalkonium Chloride Tincture\(^8\)
   a 0.1% solution in 50% alcohol and 10% acetone.

Techniques

1. One-half ml. of each of the cultures of each of the test bacteria was added separately to 5 ml. of each of the 9 different medications. Transplants of one loopful (4 mm.) and 0.1 ml. separately were made at intervals of 5, 10, 15, 30, 45, and 60 minutes and every half hour thereafter for 4 hours, then every hour until 10 hours had elapsed and the final transplant at the end of 24 hours. All trans-  

\(^1\) Marketed as Betadine® Antiseptic.  
\(^2\) Marketed as Lavacol®.  
\(^3\) Marketed as Mercurochrome® Solution.  
\(^4\) Marketed as Tincture Metaphen®.  
\(^5\) Marketed as Tincture Merthiolate®.  
\(^6\) Marketed as pHisoHex®.  
\(^7\) Marketed as Zephiran® Chloride Solution.  
\(^8\) Marketed as Zephiran® Chloride Tincture.
plants were incubated at 37°C. for one week and examined daily during this period.

2. Injector-type razor blades were used as a nonabsorbant surface. They were washed in acetone to remove adhering oil and/or grease, and sterilized in Petri dishes in the hot-air oven at 180°C. for 2 hours. The dry blades were then immersed individually into different test spore suspensions (1,000,000 per ml.), allowed to drain for one minute, and then placed in sterile Petri dishes (with Brewer open-type covers). The latter were kept at 37°C. for 72 hours. The dry blades were then immersed individually in 10 ml. of each of the above antiseptic solutions. At intervals of one-half hour for 4 hours, then every hour until 10 hours had elapsed, and the final transplant at the end of 24 hours, the blades were removed, drained of excess of medicament, rinsed in sterile isotonic salt solution, and transplanted in glycollate broth containing 0.5% sodium thiosulfate, 0.5% Tween® 80, and 0.07% lecithin. The transplants were incubated at 37°C. for one week and examined daily during this period.

Findings

All of the antiseptic solutions tested, except the Povidone-Iodine Solution and the Iodine Tincture, did not kill any of the test bacteria within 24 hours either at 20°C. or at 37°C. They do not possess sporicidal efficiency.

The two iodine solutions displayed sporicidal efficiency at both temperatures. The time required varied depending upon the resistance of the individual strains and the age of the respective culture.

The Povidone-Iodine Solution and the Iodine Tincture killed in all instances within ten minutes the organisms (vegetative forms) in the 24 hour-old cultures of the three different strains of each of the three species of sporebearing test bacteria used in this study.

The Povidone-Iodine Solution and the Iodine Tincture killed other test organisms (spores) at 20°C. and at 37°C. as follows:

_B. subtilis_—two strains were killed within 2½ hours and one strain within 2 hours.

_Cl. tetani_—one strain was killed within 1½ hours and two strains within 2 hours.

_Cl. perfringens_—two strains were killed within 2½ hours and one strain was killed within one hour.
Summary and Conclusions

Nine different skin antiseptics were tested for their sporicidal efficiency at 20°C. and at 37°C. Young and old cultures and razor blades on which were dry spores of the following test bacteria were used: three different strains of each of Bacillus subtilis, Clostridium tetani, and Clostridium perfringens. The in vitro techniques included the use of both wet and dry spores and contact time over a 24-hour period.

Seven of the antiseptics tested, including the mercurials, quaternary compounds, hexachlorophene and ethyl alcohol, did not possess sporicidal efficiency within a contact period of 24 hours.

Povidone-Iodine and Iodine Tincture, U. S. P. possess sporicidal efficiency. Even spores in one month-old cultures of the most resistant strains of B. subtilis, Clostridium perfringens, and Clostridium tetani were killed within a period of 2½ hours.

REFERENCES

(2) Claudius, Deut. Z. Chirurgie, 44:489 (1902).
(5) Simmons, J. S., ibid., 91:704 (1928).
POVIDON-JOD ALS SPORIZID
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Zusammenfassung und Schlüsse


7 der untersuchten Antiseptika, einschließlich Quecksilber-Verbindungen, quaternäre Verbindungen, Hexachlorophen und Ethylalkohol besassen keine sporizide Wirksamkeit innerhalb einer Kontaktzeit von 24 Stunden.

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Louis Gershenfeld


**PVP-Jod als Sporizid**

Neun verschiedene Hautantiseptika wurden auf ihre sporizide Wirksamkeit bei 20°C und 37°C untersucht. Es wurden neue und alte Kulturen untersucht sowie Rasierklingen mit trockenen Sporen drei verschiedener Stämme von

*Bacillus subtilis*
*Clostridium tetani*
*Clostridium perfringens*

Die in-vitro Techniken umfassten feuchte und trockene Sporen. Die Kontaktdauer betrug 24 Stunden

Alle Hautantiseptika, darunter Quecksilberverbindungen, quaternäre Verbindungen, Hexachlorophen und Aethylalkohol besaßen mit der **Ausnahme von PVP-Jod** keine sporizide Wirksamkeit innerhalb von 24 Stunden.

**PVP-Jod besitzt eine sporizide Wirksamkeit.** Selbst Sporen in 1 Monat alten Kulturen der resistentesten Stämme von *B. subtilis*, *Clostridium perfringens* und *Clostridium tetani* wurden innerhalb von 2 ½ Stunden abgetötet.